Bank Regulation, Credit Ratings, and Systematic Risk

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Summary of Paper

- Rating agencies claim that the *credit rating* of a bond or loan reflects its *expected default losses*.
- Standard finance theory predicts that the *credit spread* of a bond or loan equals its *expected default losses plus* a premium reflecting its *systematic default risk*.
- Our paper presents:
  1. a model similar to Kupiec (2004) and Pennacchi (2006) that shows if regulatory capital standards and deposit insurance premia are calibrated to credit ratings, banks will maximize their shareholder value by holding loans and bonds having the highest systematic risk for a given credit rating.
  2. empirical evidence confirming the model's assumption that bond credit spreads incorporate significant systematic risk premia not accounted for by credit ratings.

Theory: Fair Capital and Insurance Standards

- Using standard contingent claims models of Merton (1974 *JF*, 1977 *JBF*), a deposit-insured bank's fair capital standards and deposit insurance premium can be derived.
- Capital is fair when the bank's *risk-neutral* expected loan and bond default losses in excess of capital equals the bank's deposit insurance premium.
- Importantly, if loans and bonds have systematic risk (are more likely to default during an economic downturn), then risk-neutral expected default losses exceed actual (physical) expected default losses.

Practice: Capital and Insurance Standards

- Basel II and III's Standardized Approach sets risk-based capital charges based on external credit ratings:

Basel Standardized Approach: Claims on Corporates

Credit Rating	AAA to AA-	A+ to A-	BBB+ to BB-	Below BB-	Unrated
Risk Weight	20%	50%	100%	150%	100%

- Basel's Internal Ratings-Based Approach categorizes a bank's bond or loan based on its expected default losses ($PD \times LGD$). The resulting capital charge assumes systematic risk (the debt's beta) is the same for a given asset class (e.g., all corporate debt).
- Moreover, (FDIC) deposit insurance premia are often risk-insensitive or based on credit ratings or estimates of expected losses from the bank's failure.

Moral Hazard: Excessive Systematic Risk

- Thus, in practice, capital standards and deposit insurance premia are set such that a bank's loans and bonds are assumed to have the same systematic risk (debt beta) across broad asset classes.
- Extending Merton *JF* (1974), *JBF* (1977), and Galai and Masulis *JFE* (1977), the paper's model demonstrates that a bank will maximize the value of its shareholders' equity by investing in the highest systematic risk loans and bonds of a given credit rating class.
- The increase in bank shareholder value results from a greater government deposit insurance subsidy.
- As a result, banks will herd into systematically risky assets, and capital will be (mis-) allocated toward highly procyclical investments.

Empirical Evidence

- We test our theory's foundation by analyzing whether a bond's credit spread incorporates its issuer's systematic risk or "debt beta" after accounting for the bond's credit rating.
- We examine 3,924 bonds issued by 620 listed North American, European, and Japanese firms from 1999 to 2010.
- Data from DCM Analytics gives each bond's issue credit rating and credit spread at the time of issue.
- Following Galai and Masulis *JFE* (1976), we calculate each issuer's debt beta, residual volatility, and total volatility from its shareholders' equity returns and capital structure.

Credit Spreads for Low vs High Beta Issuers

All Issues (3,924 Bonds)								
Maturity	Debt Beta below median (0.038)				Debt Beta above median (0.038)			
	AA	A	BBB	Total	AA	A	BBB	Total
≤ 10 years	65.68	77.47	119.45	84.19	114.11***	144.87***	165.86***	143.04***
> 10 years	73.55	108.80	167.84	110.49	128.36***	162.52***	202.070*	162.59***
Total	66.87	82.68	126.19	88.25	115.40***	146.53***	168.41***	144.72***
Excluding 2008-10 (2,599 Bonds)								
Maturity	Debt Beta below median (0.020)				Debt Beta above median (0.020)			
	AA	A	BBB	Total	AA	A	BBB	Total
≤ 10 years	51.22	64.86	85.06	64.98	67.84***	90.48***	88.44	85.05***
> 10 years	74.18	100.17	131.21	96.94	106.71***	124.740**	156.027*	129.90***
Total	55.01	70.91	91.24	70.11	72.68***	94.26***	94.34	89.75***

Figure: Credit spreads in basis points. ***, **, * indicate statistical significance (1%, 5%, 10%, respectively) of the t-test for the equality of the spreads of issuers having below median and above the median debt betas.

Credit Spreads Across Debt Betas and Currencies

Average Euro Denominated Bond Spreads (in basis points)			
Debt Beta Quartile	Rating		
	AA	A	BBB
1	52.22	83.20	123.73
2	89.48	107.40	146.93
3	121.66	170.89	214.59
4	145.03***	210.22***	320.15***
Total Observations	304	492	346
Average US Dollar Denominated Bond Spreads (in basis points)			
Debt Beta Quartile	Rating		
	AA	A	BBB
1	79.98	114.93	262.75
2	105.54	147.98	252.79
3	126.84	191.29	200.43
4	141.93***	197.83***	336.89**
Total Observations	349	432	164

Figure: Credit spreads in basis points. ***, **, * indicate statistical significance (1%, 5%, 10%, respectively) of the t-test for the equality of the adjusted spreads of bonds in the first and fourth debt beta quartiles.

A Bond Picking Exercise

- Consider the effects of a bank simply choosing high credit spread bonds for each Basel credit rating class.
- Suppose for each year, currency (EUR, USD, JPY), maturity ($\leq$ 10Y, $>$ 10Y), and Basel credit rating class (AA, A, BBB), a bank invests in those newly issued bonds with above median credit spreads.
- The following table shows that, on average, the bank's bonds would have a debt beta (systematic risk) 18% above average.
- If the bank chose bonds having the top quartile of spreads, debt beta would be approximately 50% above average and the bank's fair capital would need to be around 10% greater.

Average Increase in Beta from Picking Bonds with Above Median Credit Spreads

Maturity	EUR	USD	JPY	Total
≤ 10 years	0.190***	0.183***	0.129***	0.169***
> 10 years	0.341***	0.219***	0.108	0.201***
Total	0.212***	0.196***	0.123***	0.178***

Figure: The average of the log ratio of the beta of high-spread bonds to the beta of all the bonds within the same category. ***, **, * indicate statistical significance (1%, 5%, 10%, respectively) of the t-test for the equality of the mean log ratios to zero.

Regression Analysis of Credit Spreads

- To more formally examine the relationship between credit spreads, ratings, and risk, we run the regression:

$$Spread_{i,t} = f\left(Rating, Debt\ Beta, Debt\ Res.Vol., Controls\right) + \varepsilon_{i,t}$$

- The following table shows that, controlling for credit ratings, credit spreads increase with the beta of the issuer's debt but not its residual volatility (idiosyncratic risk).

Determinants of Credit Spreads

	(1)	(2)	(3)	(4)	(5)
	Whole Sample			Excluding 08-10	Whole
AA+/Aa1	73.641***	82.059***	82.158***	3.797	75.990***
AA/Aa2	83.889***	92.379***	92.150***	5.477	81.549***
AA-/Aa3	109.311***	111.737***	111.650***	17.742*	98.391***
A+/A1	117.662***	119.570***	119.276***	21.217**	107.155***
A/A2	133.765***	134.584***	134.284***	31.379***	121.631***
A-/A3	152.259***	154.257***	153.903***	42.027***	139.632***
BBB+/Baa1	182.061***	182.894***	182.433***	57.829***	166.114***
BBB/Baa2	199.850***	196.790***	196.316***	62.452***	178.798***
BBB-/Baa3	211.318***	208.639***	208.109***	76.344***	188.046***
Debt Beta		108.781***	105.424***	67.799***	41.618**
ln (Debt Residual Volatility)			0.432	0.803	2.555
Crisis (2008-10)					93.842***
Debt Beta × Crisis					228.267***
Obs.	3,924	3,924	3,924	2,599	3,924
Adj. R^2	0.610	0.623	0.623	0.642	0.601

Figure: The dependent variable is each bond's credit spread. ***, **, * indicate significance at 1%, 5%, 10% level, respectively.

Controlling for Illiquidity in Bond Spreads

- Bond spreads might reflect an illiquidity component in addition to a credit risk component.
- If somehow illiquidity is associated with the issuer's systematic risk, the debt beta may be picking up this effect.
- To better control for illiquidity, we obtained bid-ask spreads shortly after issue on 2,395 of the 3,924 bonds.
- The following table shows that after controlling for illiquidity by including bonds' bid-ask spreads, bonds' spreads continue to be strongly related to their issuers' debt betas.

Determinants of Credit Spreads with Bid-Ask

	(1)	(2)	(3)	(4)	(5)
	Whole Sample			Excluding 08-10	Whole
AA+/Aa1	87.790**	100.594**	100.418**	-4.890	92.318**
AA/Aa2	99.555***	113.670***	114.855***	3.097	104.580***
AA-/Aa3	119.208***	129.359***	130.239***	13.445*	117.376***
A+/A1	119.658***	128.089***	129.438***	16.726**	119.009***
A/A2	137.262***	143.876***	145.402***	24.437***	135.210***
A-/A3	146.725***	153.758***	155.407***	37.334***	142.834***
BBB+/Baa1	169.333***	174.518***	176.557***	55.574***	162.262***
BBB/Baa2	190.508***	191.277***	193.208***	57.731***	179.135***
BBB-/Baa3	206.119***	207.675***	209.928***	88.358***	192.440***
Debt Beta		131.123***	139.492***	75.937***	65.137***
ln (Debt Residual Volatility)			-1.185	-0.063	0.819
Crisis (2008-10)					106.996***
Debt Beta × Crisis					299.626***
Avg Bid-Ask Spread	103.655***	89.896***	90.439***	61.144***	112.314***
Obs.	2,395	2,395	2,395	1,732	2,395
Adj. R2	0.641	0.659	0.659	0.662	0.637

Figure: The dependent variable is each bond's credit spread. ***, **, * indicate significance at 1%, 5%, 10% level, respectively.

Additional Empirical Evidence

- Regressing credit ratings on the issuer's debt beta, residual volatility, and control variables, we find ratings reflect debt residual volatility, but not beta, for the overall 1999-2010 sample. However, debt beta is reflected when the years 2008-2010 are excluded (c.f., Hilscher and Wilson (2010)).
- However, both Moody's and S&P ratings fail to incorporate debt beta to the extent reflected in bond credit spreads.
- We find that Moody's and S&P ratings are more likely to agree when the issuer has a high debt beta; that is, when the issuer's default depends on systematic, rather than idiosycratic, factors.

Empirical Evidence from Other Research

- Coval Jurek, and Stafford *AER* (2009) show that highly-rated tranches of MBS, ABS, and CDOs had extreme systematic risk because pooling diversifies away assets' idiosyncratic risks.
- Collin-Dufresne, Goldstein, and Yang *JF* (2012) find that these highly-rated tranches had high credit spreads commensurate with their high systematic risk.
- Our theory of rating-based capital regulation can explain banks' attraction for holding these highly-rated tranches.
- Becker and Ivashina (2012) find that insurance companies, which are also subject to credit ratings-based capital standards, invest in bonds that have relatively high credit spreads for a given credit rating, indicating excessive systematic risk-taking.

Reforms

- Basel II IRB capital standards can adjust for systematic risk across asset classes (credit cards, res. mortgages, consumer loans, com. mortgages, corporates) because regulators choose the market correlation for the class.
- But they could not adjust for systematic risk within asset class.
- Basel III better discriminates between the systematic risk of securitized versus "resecuritized" (e.g., CDO) assets.
- However, more can be done to base corporate capital charges on the issuer's systematic risk, such as using information on the issuer's debt beta or the issue's credit spread.

Conclusions

- Capital standards based on credit ratings or expected default losses create moral hazard for banks and insurance companies to take excessive systematic risk.
- Basel II credit rating-based capital charges encouraged banks to hold highly-rated structured tranches.
- The result of banks' excessive systematic risk was a systemic financial crisis.
- Risk-based capital standards and deposit insurance need to account for bonds' and loans' systematic risk as reflected in their market credit spreads.